CLAIMS

What is claimed is:

1. An apparatus for performing high speed welding of materials comprising:

an outer vessel having an inner surface and a central axis;

at least one inner vessel positioned within the outer vessel and adapted to receive at least two objects to be subjected to a welding process;

means for rotating the inner vessel with respect to the outer vessel; and

a vacuum source communicating with the inner vessel, the vacuum source adapted to generate a vacuum within the inner vessel while the inner vessel is rotating relative to the outer vessel.

2. The apparatus of claim 1 further comprising a housing disposed about the outer vessel, and wherein the vacuum source is mounted to the housing and adapted to evacuate the housing.

3. The apparatus of claim 1 wherein the means for rotating the inner vessel with respect to the outer vessel includes a drive system having a rotatable drive shaft, the rotatable drive shaft being engaged with the at least one inner vessel for rotating the inner vessel about a central axis which is co-linear with a central axis of the outer vessel, and a traction surface formed between the inner vessel and the outer vessel, the traction surface providing a frictional interface which facilitates rotation of the inner vessel with respect to the outer vessel.

4. The apparatus of claim 3 further comprising a housing disposed about the outer vessel, and wherein the vacuum source is mounted to the housing and adapted to evacuate the housing.

5. The apparatus of claim 3 wherein the inner vessel has a cover, a vacuum port and a valve, and wherein the vacuum source is adapted to connect to the port on the inner vessel for evacuating the inner vessel after the two objects have been placed within the inner vessel.

6. The apparatus of claim 1 wherein the means for rotating the inner vessel with respect to the outer vessel includes

at least one intermediate roller mounted between the at least one inner vessel and the outer vessel, the intermediate roller having a portion which is engaged with an inner surface of the outer vessel and a portion which is engaged with an outer surface of the inner vessel,

a drive system having a rotatable drive shaft, the rotatable drive shaft being engaged with the intermediate roller for causing the roller to roll along the inner surface of the outer vessel, and

wherein the inner vessel is rotated by the intermediate roller as the intermediate roller rolls along the inner surface of the outer vessel.

7. The apparatus of claim 6 wherein the portion of the intermediate roller that engages with the outer surface of the inner vessel has a diameter that is less than the diameter of the portion of the intermediate roller that engages with the inner surface of the outer vessel.

8. The apparatus of claim 7 further comprising a housing disposed about the outer vessel, and wherein the vacuum source is mounted to the housing and adapted to evacuate the housing.

9. The apparatus of claim 7 wherein the inner vessel has a cover, a vacuum port and a valve, and wherein the vacuum source is adapted to connect to the port on the inner vessel for evacuating the inner vessel after the two objects have been placed within the inner vessel.

10. The apparatus for claim 1 wherein the outer vessel is non-rotatable, wherein the means for rotating the inner vessel with respect to the outer vessel includes at least one intermediate vessel located within the outer vessel, the intermediate vessel having an outer surface which contacts an inner surface of the outer vessel, and a drive system engaged with the intermediate vessel and adapted to roll the intermediate vessel along the inner surface of the outer vessel, and wherein the inner vessel is mounted within the intermediate vessel and has a central axis, the inner vessel being positioned within the intermediate vessel such that the central axis of the inner vessel is spaced apart from the central axis of the outer vessel.

11. The apparatus of claim 10 further comprising a housing disposed about the outer vessel, and wherein the vacuum source is mounted to the housing and adapted to evacuate the housing.

12. The apparatus of claim 10 wherein the inner vessel has a cover, a vacuum port and a valve, and wherein the vacuum source is adapted to connect to the port on the inner vessel for evacuating the inner vessel after the two objects have been placed within the inner vessel.

13. An apparatus for performing high speed welding of materials comprising:

an outer vessel having an inner surface and a central axis;

at least one inner vessel positioned within the outer vessel and adapted to receive at least two materials to be welded;

means for rotating the inner vessel with respect to the outer vessel; and

means for removal of oxygen from the inner vessel.

14. The apparatus of claim 13 wherein the means for removal of oxygen from the inner vessel is a vacuum source in communication with the inner vessel and adapted to remove oxygen from the inner vessel.

15. The apparatus of claim 14 wherein the inner vessel has a cover, a vacuum port and a valve, and wherein the vacuum source is adapted to connect to the port on the inner vessel for evacuating the inner vessel after the two objects have been placed within the inner vessel.

16. The apparatus of claim 13 wherein the means for removal of oxygen from the inner vessel includes an exhaust port and a gas supply in communication with the inner vessel, the gas supply adapted to deliver a gas into the inner vessel which forces oxygen out of the exhaust port.

17. The apparatus of claim 13 wherein the means for rotating the inner vessel with respect to the outer vessel includes

at least one intermediate roller mounted between the at least one inner vessel and the outer vessel, the intermediate roller having a portion which is engaged with an inner surface of the outer vessel and a portion which is engaged with an outer surface of the inner vessel,

a drive system having a rotatable drive shaft, the rotatable drive shaft being engaged with the intermediate roller for causing the roller to roll along the inner surface of the outer vessel, and

wherein the inner vessel is rotated by the intermediate roller as the intermediate roller rolls along the inner surface of the outer vessel.

18. The apparatus of claim 17 wherein the portion of the intermediate roller that engages with the outer surface of the inner vessel has a diameter that is less than the diameter of the portion of the intermediate roller that engages with the inner surface of the outer vessel.

19. The apparatus of claim 13 wherein the means for rotating the inner vessel with respect to the outer vessel includes a drive system having a rotatable drive shaft, the rotatable drive shaft being engaged with the at least one inner vessel for rotating the inner vessel about a central axis which is co-linear with a central axis of the outer vessel, and a traction surface formed between the inner vessel and the outer vessel, the traction surface providing a frictional interface which facilitates rotation of the inner vessel with respect to the outer vessel.

20 ~~10~~. The apparatus for claim 1 wherein the outer vessel is non-rotatable, wherein the means for rotating the inner vessel with respect to the outer vessel includes at least one intermediate vessel located within the outer vessel, the intermediate vessel having an outer surface which contacts an inner surface of the outer vessel, and a drive system engaged with the intermediate vessel and adapted to roll the intermediate vessel along the inner surface of the outer vessel, and wherein the inner vessel is mounted within the intermediate vessel and has a central axis, the inner vessel being positioned within the intermediate vessel such that the central axis of the inner vessel is spaced apart from the central axis of the outer vessel.

LRC 6/1/04

21. A method for bonding materials using high speed centrifugal motion comprising the steps of:

providing an outer vessel, an inner vessel adapted to be mounted within the outer vessel, and a drive system for rotating the inner vessel relative to the outer vessel;

placing at least two materials to be bonded together into the inner vessel;

placing the inner vessel within the outer vessel;

rotating the inner vessel relative to the outer vessel;

inhibiting the formation of an oxidation layer on the materials in the inner vessel during rotation of the inner vessel; and

allowing the materials to come into contact with one another.

22. The method of claim 21 further comprising the step of removing an oxidation layer from at least a portion of the materials in the inner vessel.

23. The method of claim 22 wherein the step of removing an oxidation layer involves subjecting the materials within the inner vessel to a surface finishing process which uses abrasive media to remove the oxide layer from the surface of at least a portion of the materials.

24. The method of claim 23 wherein the step of inhibiting the formation of an oxidation layer involves filling the inner vessel with a gas which inhibits the formation of an oxidation layer before the step of removing the oxidation layer.

25. The method of claim 23 wherein the step of inhibiting the formation of an oxidation layer involves evacuating air out of the inner vessel before the step of removing the oxidation layer.

26. A method for bonding materials using high speed centrifugal motion comprising the steps of:

providing an outer vessel, an inner vessel adapted to be mounted within the outer vessel, and a drive system for rotating the inner vessel relative to the outer vessel;

placing at least two materials to be bonded together into the inner vessel;

creating a vacuum within the inner vessel;

placing the inner vessel within the outer vessel;

rotating the inner vessel relative to the outer vessel; and

allowing the materials to come into contact with one another.